Evaluation of Adding Oxygen to the Existing and Proposed New Large Holding Tanks at Tracy Fish Collection Facility

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Summary

This study will investigate the addition of oxygen to the current Tracy Fish Collection Facility (TFCF) holding tanks. As temperatures increase, dissolved oxygen (DO) saturation is reduced (Wedemyer 2001), thus as the temperature increase at TFCF the DO concentrations in the water at TFCF is reduced. Historically, from April to September influent DO concentrations entering the tanks have dropped below 5 ppm (USBR 2010). When this occurs, the DO in the holding tanks is also limited. For many fish species present at the TFCF, DO concentrations above 7 ppm are recommended for holding (Bridges 2010, personal communication). When DO drops below this level, the chance fish have of surviving the fish collection process is reduced. Adding oxygen to raise the dissolved oxygen (DO) concentrations can increase fish survival. Many techniques and methods are commercially available which allow DO to be increased by either natural methods or by adding pure oxygen directly to the tanks with airstones. However, adding DO to the holding tanks is not a trivial endeavor. This research will determine the most cost effective method to increase the DO in the existing holding tanks without changing salvage operations.

Problem Statement

For fish survival, DO concentration in the existing and new holding tanks should be 7 ppm. As mentioned previously it is possible during hot weather for DO concentrations in the holding tanks to drop below 5 ppm. As a result, to help

fish have the best chance of surviving the collection process, oxygen needs to be added to the holding tanks. Unfortunately raising DO levels in holding tanks is not a trivial process. Methods such as adding pure oxygen with airstones presents a unique challenge because airstones can be difficult to keep clean; perform differently depending on supply line pressure, depth and size; and can present operational concerns. Other methods such as gravity aeration can be problematic because hydraulic head must be available to provide an adequate water drop to entrain air in the water. Both problems present concerns that can be resolved through laboratory testing.

Goals and Hypothesis(ses)

Goals:

1. What method and quantity of aeration will be the most effective at increasing DO concentrations in both the existing holding tanks and the proposed new holding tank at the TFCF?

Hypotheses:

1. Aeration can occur through many different processes. It is our hypothesis that an aeration system can be designed that will allow DO in the holding tanks and TFCF to be increased and as a result increase fish survival.

Materials and Methods

Phase 1: Literature Review

A comprehensive literature will be used to help fully understand the available methods of increasing the DO in the holding tanks at TFCF. The instruments found during the literature review will be commercially located and specifications will be compiled. During the literature review researchers will investigate different materials, bucket shapes and valve options that will allow better operations of the lift bucket used to get the fish into the count station.

Phase 2: Laboratory Testing

During Phase 2, any commercially available products that do not have efficiency specifications will be tested at the TSC Hydraulics Laboratory, Denver, Colorado. Tests will be conducted in the prototype circular holding tank constructed in 2007. DO concentrations will be collected with a water quality meter from the influent and compared to the DO from the effluent to determine the efficiency of each tested device. Determining the correct pressure, aerator and inflow oxygen concentrations through laboratory research will allow the TFCF to aerate the holding tanks with confidence. Considerations for each aerators lifetime, and maintence, replacement and installation ease will be looked at.

Phase 3: Field Implementation

Phase 3 will consist of a meeting to discuss the results of Phase 2. During the meeting TFCF engineers, managers, biologist and operators will be able to

provide input as to which method of aeration will be most effective for TFCF. Field implementation will follow.

Coordination and Collaboration

The study will be completed with strong coordination between TFCF operators, Reclamation biologists, fisheries and engineering staff. Constant communication between all parties will ensure that needs are met. Findings will be presented to the Tracy Technical Advisory Team (TTAT) at a future agency meeting.

Endangered Species Concerns

No permitting will be required for this project. Studies will be performed in the laboratory and have no contact with fish species.

Dissemination of Results (Deliverables and Outcomes)

Progress reports will be issued with project findings and future goals at the end of each fiscal year. At the conclusion of the project a Tracy Technical Report will be produced.

Literature Cited

Bridges, B. 2010. U.S. Bureau of Reclamation, Tracy Fish Collection Facility, personal communication.

USBR (United States Bureau of Reclamation). 2010. Multiprobe water quality data from the Tracy Fish Collection Facility, Byron, California. Web accessible http://www.usbr.gov/pmts/tech_services/tracy_research/data/Multiprobe.html

Wedemeyer, G.A. 2001. *Fish Hatchery Management.* Second edition. Bethesda, Maryland, American Fisheries Society.